

California On-line Optimizing System for Scheduling and Updating Schedules (COLOSSUS)

This is a system of over 15 models that represent various parts of the State Water Project. In 1983, part of the COLOSSUS system was implemented to facilitate energy market transactions between the Department of Water Resources and other power utilities. This initial implementation allowed for manual input of hourly pumping schedules and programatic balancing of power schedules. The goal was to complete development of an extended system that would allow for automatic generation of both water and power schedules; this implementation was never completed.

Individual models within the COLOSSUS system were considered for the FERC relicensing effort; these alternative modeling approaches were abandoned earlier in the process because of (1) the difficulty in separating the models from the COLOSSUS system, (2) lack of staff with experience with the COLOSSUS models to support the relicensing modeling needs, (3) difficulty in modifying the models to add proposed features, and (4) onerous data requirements for the various COLOSSUS models. Below is a brief description of the various models within the COLOSSUS system that were considered:

Annual Model: This model simulates the Oroville – San Luis Reservoir system using a monthly time step and one-year planning horizon. The model does not simulate Central Valley Project operations and requires explicit definition of downstream requirements (i.e. Delta criteria). The model was never verified by operations staff.

ORONET: This model simulates the Oroville Complex with either a weekly or daily time step. The purpose of the model is to determine the weekly or daily overall release requirement for the Feather River. The model requires explicit definition of downstream requirements.

OROHYD: This model simulates the Oroville Complex hourly or periodic operations (prior to deregulation, there were 12 on/off peak periods defined during the week). It's purpose is to determine if a pre-defined generation schedule is operationally feasible. To ensure the pattern is met as closely as possible, the model penalizes deviations from the pre-defined schedule.

Delta Coordinated Operations Model

The DCO is an EXCEL spreadsheet that is used by the Operations Control Office for various operation analyses of the SWP and CVP northern system. The model represents operations at a monthly time step for a 12-month period; there is no logic built into the spreadsheet to allow the model to simulate operator decisions. Use of this model within the FERC relicensing effort was considered early in the process. The model provides for flexibility and is easy to operate. However, it is not intended for use with multi-year analyses and would require extensive support by operations staff.

Oroville Simulation Model

The Oroville model, OROTHM1, simulates the Oroville complex monthly power operations on a single year basis. The model operates the powerplants at their available capacity, which includes unit outage information. It also models the existing power contract between the Department and Southern California Edison (SCE). Power generation is calculated based on the water that has to be released to meet flood control criteria, Thermalito Afterbay demands, Feather River requirements, Delta standards, and SWP exports. OROTHM1 optimizes generation during the on-peak period, which is assumed to be from 0800 to 2200, the same as in the SCE power contract. OROTHM1 also has the ability to model pumpback operations together at Hyatt and Thermalito PGP; however, this feature has not been used for power planning purposes.

The Oroville model is currently being used for short term power operations planning. However, this model is not recommended for use in the Oroville relicensing process due to many of its limitations. First of all, it's not designed for a multi-year simulation study nor does it model the Thermalito Diversion Dam Power Plant. Secondly, this model does not have the ability to forecast temperature at the Fish Hatchery. In addition, the model does not allow users to define the on/offpeak periods. Last of all, this model seems to over optimize the onpeak generation at Oroville and its inputs/outputs are not user friendly.

OPERATIONS SIMULATION MODELS

The PROSIM, DWRSIM, CALSIM, and CALSIM II all are monthly time step, operation simulation, long-range planning models of the SWP/CVP system. While the models all simulate the same basic system there are significant differences between them. CALSIM II was selected from these models as the appropriate tool to use in the Oroville Facilities relicensing process. Brief summaries of these models are included below.

PROSIM – This model was developed and used by USBR for long term planning and analysis of the CVP system. The SWP, including Oroville Reservoir operations are only modeled to develop a “boundary” condition for the CVP operations. The model is in use by USBR and others for analysis where the attention is on the CVP operations. This model will be replaced with the CALSIM II model when development is completed. Use of this model is not appropriate for Oroville Facilities relicensing because it focuses on CVP operations and represents a relative lack of focus on SWP operations including Oroville Reservoir operations.

DWRSIM – This model was developed and used by DWR for long term planning and analysis of the SWP system. DWRSIM is no longer used by DWR, it has been replaced by the CALSIM model for recent DWR planning efforts. Use of this model is not appropriate for Oroville Facilities relicensing because it is no longer supported or used by DWR.

CALSIM – This is the DWR replacement for DWRSIM. The model was originally developed to reproduce the results of DWRSIM using a new, linear programming engine to allow for easier model development and application. This model is subject to the same basic limitations as DWRSIM, except that it is still in use and has undergone development since it replaced DWRSIM.

CALSIM II – This is a joint DWR/USBR model of the SWP/CVP system. The model is based on the CALSIM model with a number of changes and enhancements designed to model both the SWP and the CVP systems to meet long term planning needs of DWR and USBR. The model contains a number of major enhancements over PROSIM, DWRSIM and CALSIM including a jointly approved hydrology, individual and joint SWP/CVP operations, and a jointly developed and approved b(2) and EWA implementation. A set of baseline simulations using this model currently under development to serve as the baseline simulations for CALFED and other processes that affect SWP/CVP operations. The advantages of this model over the others include:

- Agreement on hydrology
- Agreement on SWP/CVP operation simulation process
- Agreement on b(2) and EWA implementation
- Baseline simulations to provide starting point for our analysis
- Extensive recent development and verification effort on the model

Temperature Models

USBR Feather River and Oroville Reservoir Temperature Models – These are monthly time step temperature models developed by USBR for use with the USBR PROSIM operation model results. Since the USBR is not concerned with

SWP operations on the Feather River except insofar as they impact CVP operations at other locations these models have received very limited calibration, verification, and practical application. These models are not suitable for use in the operations modeling for the Oroville Facilities relicensing due mainly to the monthly time step.

We are proposing to use the Oroville Reservoir temperature model for some preliminary analysis of the availability of cold water in Oroville Reservoir for temperature control downstream portion of the Feather River. There is a critical need for this information to assist in the development of other study plans. Since this is the only available Oroville Reservoir temperature model it will be used to develop preliminary information to be used in study plan development. If desired the analysis will be repeated with any new Oroville Reservoir temperature model developed for the Oroville Facilities relicensing process.

UC Davis Feather River Temperature Model – This is a one dimensional, finite element, hydrodynamic and water quality model of the Feather River from the fish barrier dam downstream to the confluence with the Sacramento River. The model was calibrated using data from July 1998 and verified with data from August and September 1998. The model was used to perform an analysis of how flow, temperature, and meteorological conditions affected temperatures at Robinson Riffle located on the Feather River in the low flow channel upstream of the Thermalito Afterbay return. The results of the analysis were used to develop relationships to assist DWR to meet potential temperature requirements at Robinson Riffle. We are proposing to use this model in the Oroville Facilities relicensing process.